

Researchers discover region of male mice brain involved in asserting dominance

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(Medical Xpress)—A team of researchers affiliated with several institutions in China has located a part of the brain in male mice that appears to play a key role in dominance behavior with other male mice. In their paper published in the journal *Science*, the team describes experiments they carried out with mice using brain scans, optogenetics and plastic tubes.

Mice are known to be social animals, and prior research has shown that dominance plays a role in maintaining social order—dominance levels lead to establishment of hierarchies, which helps to maintain peace within communities. While size has been shown to play a role in dominance in mice, prior research has determined that some behaviors, particularly persistence, play an even stronger role. In this new effort, the researchers sought to learn more about what goes on in the male mouse brain when males are forced into a situation in which dominant behavior is encouraged.

The experiments consisted of monitoring the brain waves of mice as they performed a standard dominance test—two male mice were placed nose-

to-nose into a clear tube that did not leave enough room to turn around or pass by one another. The only way out was for one to concede and walk backwards to the end of the tube and exit. In so doing, the researchers found that the dorsomedial prefrontal cortex (dmPFC) was more active in the mouse that won such contests. More specifically, they found that when performing such actions as initiating a push, pushing back against a push or resisting, the dmPFC was more active. Conversely, during such activities as retreating, the same region was less active than it was for the one showing dominance.

After testing several mice, the team was able to identify which mice were more dominant—they then quashed that dominance by giving the mice a drug known to quiet the dmPFC, suggesting that they had found the correct region of the brain responsible for controlling dominance. The researchers then used optogenetics to stimulate the dmPFC in less dominant mice and found that doing so caused those mice to become more dominant—an effect that lasted for at least a whole day after photo-stimulation ceased. The researchers report that they plan to continue their research to learn if the same part of the [brain](#) is involved in [dominance](#) for female [mice](#).

More information: History of winning remodels thalamo-PFC circuit to reinforce social dominance, *Science* 14 Jul 2017: Vol. 357, Issue 6347, pp. 162-168 , [DOI: 10.1126/science.aak9726](https://doi.org/10.1126/science.aak9726)

Abstract

Mental strength and history of winning play an important role in the determination of social dominance. However, the neural circuits mediating these intrinsic and extrinsic factors have remained unclear. Working in mice, we identified a dorsomedial prefrontal cortex (dmPFC) neural population showing "effort"-related firing during moment-to-moment competition in the dominance tube test. Activation or inhibition of the dmPFC

induces instant winning or losing, respectively. In vivo optogenetic-based long-term potentiation and depression experiments establish that the mediodorsal thalamic input to the dmPFC mediates long-lasting changes in the social dominance status that are affected by history of winning. The same neural circuit also underlies transfer of dominance between different social contests. These results provide a framework for understanding the circuit basis of adaptive and pathological social behaviors.

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